

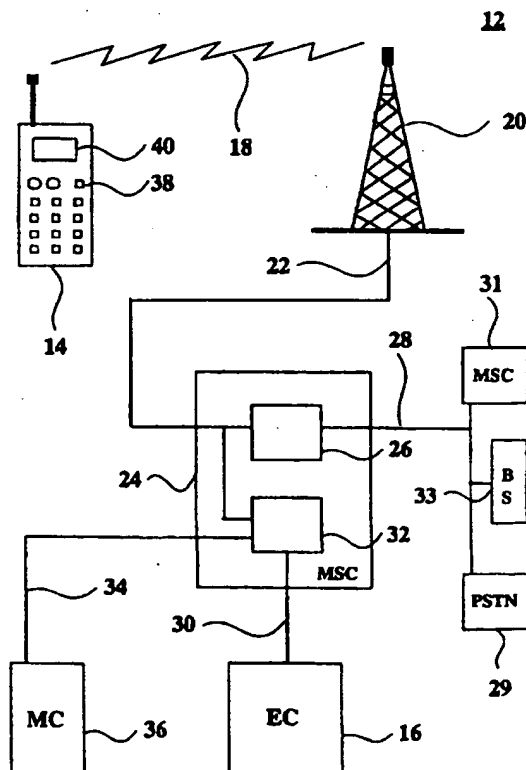


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**(54) Title:** EMERGENCY CALL HANDLING IN A CELLULAR TELECOMMUNICATIONS SYSTEM**(57) Abstract**

There is disclosed an emergency call handling system and method for a cellular telecommunications system (12). The emergency call handling system is provided with at least one subscriber terminal (14) which upon failure to seize a voice connection to an emergency center (16) for an emergency call, transfers short messages over the digital control channel to the emergency center (16) advising it that the user of this one subscriber terminal (14) has an emergency situation. Advantage is found with the present invention in that in times of radio voice channel and/or network traffic congestion resulting in call set up failure, the information relating to a user emergency can be forwarded as short messages to the emergency center.



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## EMERGENCY CALL HANDLING IN A CELLULAR TELECOMMUNICATIONS SYSTEM

### BACKGROUND OF THE INVENTION

#### 5        Technical Field of the Invention

The present invention relates to an emergency call handling system for a cellular telecommunication system. In particular, the present invention is directed to forwarding user emergency information via data messages over the radio digital control channel and across the network to an emergency center when emergency voice  
10       calls cannot be set up when, for example, there exists radio voice channel congestion, network congestion, or both.

#### Background of the Invention

Providers of emergency services in North America such as in fire, police, and rescue departments are assisted in providing emergency services by the introduction  
15       of the 911 emergency number. One of the important aspects of the 911 emergency service is the public safety answering point (PSAP) system which acts as an emergency center (EC) for handling emergency calls.

All 911 calls originating from the cellular and landline telephone networks are routed to the closest PSAP for service. The PSAP also obtains the telephone number  
20       of the calling party from the network. Utilizing this calling telephone number, the PSAP accesses a remote database containing information relating to telephone numbers to users' names and addresses. For a landline telephone, the billing address is the address where the telephone is located. The address information is important  
25       since often the calling party is incapable of supplying the location information or does not have sufficient time to supply this information. The location information then allows the PSAP to direct assistance to the landline telephone user involved in the emergency.

As described above, 911 calls originating from the cellular network are routed to the PSAP similarly as 911 calls originating from a landline network. However, due  
30       to the unique nature of the cellular system, other methods have also been established to aid in emergency call handling.

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For example, it is known to have a 911 button, or some other pre-programmed button, on the terminal or mobile station (MS). Such a feature is disclosed in U.S. patent 5,365,570 issued to Boubelik on November 15, 1994 where the MS can be dedicated to emergency use. Other known MS features to aid in emergency calls are auto-power on, remote actuation of a call, and auto dial (and redial) of a pre-programmed emergency number.

In another example, once a call is successfully set up in the cellular network, it is known to transmit on the voice channel, geo-coordinates of the location where the MS is located. Such a method is disclosed in U.S. patent 5,388,147 issued to Grimes on February 7, 1995. Grimes further teaches converting the geo-coordinates into conventional municipality or rural address locations when the emergency call is initiated.

While the known prior art teaches methods that facilitate the transmittal of information to the PSAP from MS's, these methods are based on the premise that the user of the cellular telephone is able to make a voice call connection to the PSAP. This voice call connection comprising of a radio voice channel and a network voice trunk connection between the mobile switching center (MSC) and the PSAP. However, it should be understood that in the cellular industry, the number of radio voice channels allocated to a particular cell site are limited and may be all in use resulting in failure to set-up a call. Also even when a radio voice channel is successfully allocated, the call may still not be set up be due to network congestion elsewhere in the cellular system.

Furthermore, the probability of failing to set-up a call increases significantly in the case of a large scale disaster like an earthquake where the network is flooded with emergency calls. This is also true for local emergencies such as a major traffic highway accident in which several subscribers may be trying to access the same cell associated with that part of the highway. In such situations the user may attempt to call the PSAP many times and still not be able to establish a voice call connection. If the terminal is low on battery power and several attempts are made to contact the PSAP, then it is possible that the terminal may run out of battery power during these attempts and the PSAP will never be informed of the user's emergency.

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Accordingly, there is a need to provide a method and system of informing the PSAP of the user's emergency in the event the user of a MS is unable to obtain a voice call connection to the PSAP.

#### Summary Of The Invention

5       The present invention is directed towards an emergency call handling system for a cellular communication system. The emergency call handling system is provided with at least one subscriber terminal which upon failure to seize a voice call connection to an emergency center (EC) on an emergency call, transfers data messages, these messages preferably being of the type of data messages known as  
10       short message service (SMS) messages, over the radio digital control channel (DCC) through a base station (BS) and a mobile switching center (MSC) to the EC advising the EC that the user of this one subscriber terminal has an emergency situation.

By sending a data message over the DCC and having the MSC analyze the data message and forward emergency data to the EC, the present invention provides a  
15       means for the terminal to communicate with the EC when a voice call cannot be set up. In particular if the voice call cannot be set up due to radio voice channel congestion and/or network congestion then data messages are sent over the DCC and across the network.

In accordance with one aspect of the present invention, there is provided an  
20       emergency call handling system for a cellular communication system for routing emergency calls made by a plurality of subscriber terminals to an EC. The system comprises a MSC for controlling signalling with a plurality of BS's. It should be understood that the term MSC means a mobile switching center typical of the D-AMPS standard telecommunications system of North America or a mobile switching  
25       center used in the GSM standard cellular telecommunications system where control of the switching of the BS's is controlled by a base station controller. The base station controller is an intermediate node located between the BS's and MSC. The system further includes at least one subscriber terminal normally communicating with the MSC through one BS over a DCC when in an idle mode and one of a plurality of voice  
30       channels (VC's) when in an active subscriber communication mode. It should be understood that the term VC includes both a digital voice channel and an analogue

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voice channel. The one terminal includes emergency call means for initiating an emergency voice call via the BS through the MSC to the EC, call failure detection means for detecting when the emergency voice call has failed to be set up with the EC, and data transmission means, responsive to a call failure detection to transmit an emergency data message over the DCC through the BS and MSC to the EC.

An advantage of this aspect of the present invention is that it permits the subscriber terminal to send a data message to the EC over the DCC without wasting time waiting for an available VC when the subscriber terminal fails to seize a voice call connection to the EC.

The EC upon receipt of the emergency data message from one terminal preferably includes means to immediately transmit an acknowledgment data message to the one terminal via the MSC and BS over the DCC. This message will include data indicating that the EC has been informed of the user emergency. In addition, the message will include data indicating that the EC will call back the user and possibly the call back time and that the user should not attempt any more calls so as to conserve the MS battery power. The EC also preferably includes call back means that, after acknowledgment of the data emergency message from the one terminal, initiates a voice call back to said one terminal through the MSC and BS over a VC.

It is envisaged within the scope of the present invention that the emergency data message from the MS will include data information identifying the data message as an emergency message and data information related to the identity of the terminal. The emergency data message may further include data information such as the user's medical history, and information corresponding to the location of the terminal possibly obtained from an associated global positioning satellite (GPS) receiver or some other locating system.

The MSC further preferably includes means for analyzing data messages received on the DCC and, once identifying an emergency data message, the MSC adds to the emergency data message, information as to the location of the terminal for the EC. This information together with the terminal information in the emergency data message will be forwarded directly to the emergency center instead of for example to the user's message center (MC) as is the usual case for SMS messages.

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Preferably, the call failure detection method located in the one terminal includes count means which counts up a pre-determined number of consecutive call failures and thereafter enables the data transmission means to transmit said emergency message. This counter is preferably factory preset to three and after the third failed attempt the emergency data message would be transmitted over the DCC. Preferably, the call failure detection method enables the data transmission means to transmit the emergency data upon the determination of a failure to be successfully allocated a radio VC. The call failure detection method further includes means, such as a busy tone detection circuit, to detect network congestion if a radio VC is successfully allocated.

The present invention has the advantage of being able to send more emergency messages in a data format over the network as compared to voice calls over the network because an emergency data message consumes less bandwidth than the equivalent emergency voice call. Accordingly, in an extreme catastrophic emergency situation, the EC would be able to receive information from more users with respect to the emergency, via data messages then it would via voice calls.

In accordance with another aspect of the present invention there is provided a method for emergency call handling in a cellular communication system for routing emergency calls made by a plurality of subscriber terminals to an EC via a MSC controlling a plurality of BS's. The method comprises the steps of:

at least one subscriber terminal normally communicating with one selected from the group of a DCC and a VC via the BS to the MSC, said one subscriber terminal:

initiating an emergency voice call to the EC over the VC to the BS and through the MSC to the EC,

detecting when the emergency voice call has failed to be set up with the EC, and

responsive to detecting a failed set up of an emergency voice call with the EC, transmitting an emergency data message over the DCC to the BS through the MSC, and

the MSC analyzing the data messages and transmitting the emergency data message directly to the EC.

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In accordance with yet another aspect of the present invention there is provided an emergency call handling system for a cellular communication system for routing emergency calls made by a plurality of subscriber terminals to an emergency center. The system comprises an MSC for controlling signaling with a plurality of BS's. The system includes at least one subscriber terminal normally communicating with the MSC through one BS. The one terminal including data transmission means for transmitting data messages including emergency data messages over a DCC through the BS to the MSC. The system includes data analyzing means in the MSC for analyzing the data messages received from said one terminal to route emergency data messages to the EC.

An advantage of this aspect of the present invention is the MSC can analyze incoming data messages and immediately route an emergency message to the EC.

In accordance with yet another aspect of the present invention there is provided a method for emergency call handling in a cellular communication system for routing emergency calls made by a plurality of subscriber terminals to an EC via a MSC controlling a plurality of BS's. The method comprises the steps of:

at least one subscriber terminal transmitting data messages, including emergency data messages, over a DCC through the BS to the MSC; and,

analyzing in the MSC data messages received from said one terminal routing emergency data messages received in the MSC to the EC.

#### BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the method and apparatus of the present invention may be obtained by reference to the following detailed description when taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a schematic drawing showing elements of the cellular telecommunication systems of the present invention;

FIGURES 2A and 2B represent flow charts for operation of the subscriber terminal of the present invention;

FIGURE 3 is a flow chart for operation of the MSC of the present invention;

FIGURE 4 is a flow chart for the operation of the EC of the present invention; and,



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FIGURE 5 is a simplified block diagram of a MS operating in the system of the present invention.

#### DETAILED DESCRIPTION OF EMBODIMENTS

Referring to FIGURE 1, there is shown an emergency call handling system 10 for use with a cellular communication system 12 for routing emergency calls made by a plurality of subscriber terminals or mobile stations (MS) 14. MS 14 communicates with the emergency center (EC) 16 via radio waves 18 to radio base station (BS) 20. The BS 20 is connected through, for example, land lines 22 to the mobile switching center (MSC) 24. The MSC 24 includes normal processing of telephone calls at 26 whereby these calls may be routed along line 28 either to another PSTN 29, MSC 31, or back to another radio base station 33. Also the MSC is provided with an analyzing means 32 which analyzes data messages received on line 22 and routes emergency data messages to the emergency center 16 along line 30. All other data messages are forwarded to the appropriate message center (MC) 36 along line 34. In the preferred embodiment, the emergency center is a public safety answering point (PSAP). It should be understood that the radio waves 18 shown between the mobile station or MS 14 and BS 20 may comprise either voice channel (VC) frequencies or digital control channel (DCC) frequencies. The use of DCC's and purposes are well known in the art.

It is within the scope of the present invention to use the DCC to transmit from the MS 14 a data message which can be in the form of a short message service (SMS) message. This data message is transferred over the DCC to the BS 20 and then along line 22 to the MSC 24. The analyzing device 32 recognizes the emergency data message and forwards it along line 30 to the EC 16. Within the scope of the present invention, the EC will acknowledge receipt of the emergency data message from the MS by transmitting a data message to the MS informing the MS of the EC's successful receipt of the MS emergency data message. The EC will then call back the MS as quickly as possible. In accordance with a preferred aspect of the present invention, the MS 14 is equipped with a panic button 38 which when pressed causes the terminal to initiate a normal emergency call to the PSAP through a voice channel seized to the BS 20. If this voice channel is not seized properly or there is a busy signal, and the emergency call fails, and subsequent automatic consecutive emergency call attempts

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up to a factory pre-set limit of three also fail then the MS will automatically send a predefined data message through the DCC to the PSAP 16 in accordance with the teachings of the present invention.

5 This data message includes information identifying the message as an emergency so that the analyzing device 32 in the MSC can identify the emergency message. The data message also provides information relating to the identification of the MS 14 and possibly other information such as the user's medical history, and possibly information corresponding to the location of MS 14 within the cellular telephone system 12. Such location identification coordinates and schemes are well known in the art. Additionally, the MSC adds cell information or location information 10 when the message is passed through analyzing means 32 of the MSC. The BS 20 may be identified as a particular cell site of several cell sites within the cellular communication system operating with MSC 24 such that the EC 16 will know the approximate location of the user of terminal 14. It should be understood that the analyzing means of the MSC may comprise some aspect of a computer within the switching system. Preferably, the MS 14 includes means to count the number of 15 failed attempts to seize a VC when the emergency panic button 34 has been pressed. After three failed attempts to seize a VC, the MS 14 can automatically send the emergency data message emergency. Alternatively, in the event that a busy tone is received by the MS, this can be an indication of network congestion and then the MS 20 14 will automatically send the data information after three failed emergency call attempts over the DCC 18 to the BS 20.

Referring now to FIGURES 2A and 2B there is shown a flow chart for the operation of the MS 14 of the present invention. Referring to FIGURE 2A, the emergency button or panic button may be pressed to start the emergency procedure at 25 41. This may involve either pushing a panic button or a series of predetermined buttons on the terminal to effect the emergency call. Such as, for example, dialing 911 and pressing the send button. At this point, the MS checks at 42 to see if in fact the MS has been powered on. If it has not been powered on it powers the MS turns on at step 44. Next the MS checks at block 46 as to whether or not the MS is idling on an analog control channel (ACC). If the MS is not idling on an ACC, then a check is 30

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made if the MS is in the speech mode at 48. If the answer is that the MS is in the speech mode at 48 then the call is terminated at 66 and the mobile goes back to step 46. In the event that the MS is not in the speech mode then the MS is locked onto a digital control channel at 50. Returning to step 46, when the MS is known to be idling on an ACC channel, then a check is made to see whether or not a DCC is available at 52. If no channel is available at that time then a send origination message is initiated at 54 which is basically a 911 message or emergency call placed on the voice channel through the RBS 20 to the MSC 24 and the PSAP 16. Such an emergency originating request message may also include additional information or may be provided with additional information as to the coordinates of the user and the identification of the user on the voice channel. However, it should be understood that this aspect forms no part of the present invention.

If a DCC channel is available at 52 then the MS 14 scans and locks onto the available DCC at 56. Next, as in accordance with steps 56 and 50 an emergency bit indicator is set at 58. If the emergency number is then stored at 60, then this also is inserted as a "B" number at 62 into the information being sent with the next step. If not, B number is skipped. At the next step, an originating message is sent on the DCC at 64. It should be noted that this origination message defers from the one on box 54 because as it is being sent over a digital control channel in an attempt to set-up a voice channel then there is additional information sent to the MSC such as the "B" number. Both steps 54 and 64 terminate in step A which again starts up in FIGURE 2B.

Referring now to FIGURE 2B once the origination of the call has been sent at 54 and 64 of FIGURE 2A, then the terminal 14 determines if the call has been completed at 80 by checking if a radio VC has been successfully allocated or by checking for network congestion by means such as a busy tone detection circuit. If the call has been completed at 80 it ends the interrogation process at 82 for the terminal 14. The terminal or MS 14 will then be aware of the fact that an actual call has been completed to the EC. If the call is not completed then the terminal checks to see if this has been the third call that has failed to go through and if the answer is no it reverts back to C which again starts up in Figure 2A at step 46. If the answer is yes then the MS checks for a control channel. If the MS idles on an ACC at 85 then a check is

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made to scan and lock on a DCC at 86. Then a data message is sent to the EC at 87, or if the MS is idling on a DCC at 85 then it proceeds directly to 87.

Referring to FIGURE 3, when the MSC receives the data message at 88 it analyzes to see if the message is an emergency message, if so, it adds location  
5 information at 90 to the data message and routes it at 92 to the PSAP. Otherwise, the message is routed to the MC at 94.

Referring to FIGURE 4, the PSAP in reply to an SMS emergency message being received at 96 the EC sends a return SMS message to the MS at 98 to inform the MS that its emergency SMS message has been successfully received by the EC. The  
10 EC will then call back the MS at 100 as soon as possible.

Referring now to FIGURE 5, there is shown a simple perspective diagram of a mobile station 14 including a processor 102 connected to a transceiver 104. The antenna 106 is connected to the transceiver 104 for transmitting and receiving communications over a cellular telephone network. The mobile station 14 further  
15 includes a microphone 108 and a speaker 110 connected to the processor 102 for facilitating telephonic voice communications. A display panel 114 and a keyboard 112 are included in the mobile station and connected to the processor 102.

Although a preferred embodiment and the method and apparatus of the present invention has been illustrated in the accompanying drawings and described in the  
20 foregoing detailed description, it will be understood that the invention is not limited to the embodiment disclosed, but is capable of numerous re-arrangements, modifications and substitutions without departing the spirit of the invention as set forth and defined in the following claims.

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## WHAT IS CLAIMED IS:

1. An emergency call handling system for a cellular communication system for routing emergency calls made by a plurality of subscriber terminals to an emergency center (EC), said system comprising:  
5 a mobile switching center (MSC) for controlling signaling with a plurality of base stations (BS's); and,  
at least one subscriber terminal normally communicating with the MSC through one BS over a digital control channel (DCC) when in an idle mode and a voice channel (VC) when in an active subscriber communication mode; and said one  
10 terminal including emergency call means for initiating an emergency voice call via the BS through the MSC to the EC, call failure detection means for detecting when the emergency call has failed to be set up with the EC, and data transmission means responsive to a call failure detection to transmit an emergency data message over the  
15 DCC through the BS and MSC to the EC.
2. The emergency call handling system of claim 1 wherein the MSC further includes means to route the emergency data message to the EC.
3. The emergency call handling system of claim 1 wherein the EC includes acknowledgment means that upon receipt of the emergency data message  
20 from said one terminal transmits an acknowledgment data message to the MSC, through the BS and over the DCC to said one terminal.
4. The emergency call handling system of claim 1 wherein the EC includes call back means responsive to the emergency data message that a call back to said one terminal through the MSC, BS and over the VC.
- 25 5. The emergency call handling system of claim 1 wherein said emergency data message includes 1) data information identifying the data message as an emergency and 2) data information relating to the identity of the terminal.
6. The emergency call handling system of claim 5 wherein the emergency data message further includes user medical history information.
- 30 7. The emergency call handling system of claim 5 wherein said emergency data message further includes data information corresponding to the

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location of the terminal.

8. The emergency call handling system of claim 1 wherein the MSC includes means for analyzing the emergency data message and adding to said emergency data message forwarded to the EC location information corresponding to the location of said terminal.

9. The emergency call handling system of claim 1 wherein the call failure detection means includes count means which counts up to a predetermined number of consecutive emergency call failures and thereafter enables the data transmission means to transmit said emergency data message.

10. The emergency call handling system of claim 1 wherein the call failure detection means enables the data transmission means to transmit said emergency data upon determination that a failure to set up a call with the VC through to the EC is the result of congestion.

11. An emergency call handling system for a cellular communication system having a plurality of cells and a plurality of subscriber terminals for routing emergency calls made by said subscriber terminals to an emergency center (EC), said system comprising:

a mobile switching center (MSC) including means to route emergency calls to the EC;

a plurality of base stations (BS's) electronically connected to said MSC, each of said BS's transmitting radio frequency signals over at least one digital control channel and a plurality of voice channels over a coverage area defining one of said cells; and

at least one subscriber terminal normally communicating with the MSC via one of said BS's over a corresponding channel selected from one of the group consisting of a digital control channel (DCC) and a voice channel (VC); and, said one terminal including emergency call means for initiating an emergency voice call to the EC via the BS and the MSC, call failure detection means for detecting when the emergency call has failed to be set up with the EC, and data transmission means, responsive to a call failure detection, to transmit an emergency data message over the DCC to the BS and through the MSC to the EC.

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12. The emergency call handling system of claim 11 wherein the EC comprises a public safety answering point (PSAP).

13. The emergency call handling system of claim 11 wherein the EC includes acknowledgment means that upon receipt of the emergency data message from said one terminal transmits an acknowledgment data message to the MSC, through the BS and over the DCC to said one terminal.

14. The emergency call handling system of claim 11 wherein the EC includes call back means responsive to the emergency data message that a call back to said one terminal through the MSC, BS and over the VC.

15. The emergency call handling system of claim 11 wherein said emergency data message includes 1) data information identifying the data message as an emergency and 2) data information relating to the identity of the terminal.

16. The emergency call handling system of claim 15 wherein the emergency data message further includes user medical history information.

17. The emergency call handling system of claim 15 wherein said emergency data message further includes data information corresponding to the location of the terminal.

18. The emergency call handling system of claim 11 wherein the MSC includes means for analyzing the emergency data message and adding to said emergency data message forwarded to the EC location information corresponding to the location of said terminal.

19. The emergency call handling system of claim 11 wherein the call failure detection means includes count means which counts up to a predetermined number of consecutive emergency call failures and thereafter enables the data transmission means to transmit said emergency data message.

20. The emergency call handling system of claim 11 wherein the call failure detection means enables the data transmission means to transmit said emergency data upon determination that a failure to set up a call with the VC through to the EC is the result of congestion.

21. A method for emergency call handling in a cellular communication system for routing emergency calls made by a plurality of subscriber terminals to an

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emergency center (EC) via a mobile switching center (MSC) controlling a plurality of base stations (BS's), said method comprising the steps of:

at least one subscriber terminal normally communicating with one selected from the group of a digital control channel (DCC) and a voice channel (VC) via the BS to the MSC, said one subscriber terminal:

initiating an emergency call to the EC over the VC to the BS and through the MSC to the EC,

detecting when the emergency call has failed to be set up with the EC, and

responsive to detecting a failed set up of an emergency call with the EC,

transmitting an emergency data message over the DCC to the BS through the MSC, and

the MSC transmitting the emergency data message to the EC.

22. The emergency call handling method of claim 21 further including the step of the EC transmitting a data acknowledgment message to said one terminal through the MSC, BS and over the DCC upon receipt of the emergency data message.

23. The emergency call handling method of claim 21 further including the step of the EC initiating a call back to through the MSC, BS and over the VC to said one terminal upon receipt of the emergency data message.

24. The emergency call handling method of claim 21 wherein said emergency data message includes 1) data information identifying the data message as an emergency and 2) data information relating to the identity of the terminal.

25. The emergency call handling method of claim 24 wherein said emergency data message further includes data information corresponding to the location of the terminal.

26. The emergency call handling method of claim 21 further including the step of the MSC analyzing the emergency data message to determine if it is an emergency message, and adding to said emergency data message forwarded to the EC location information corresponding to the location of said terminal.

27. The emergency call handling method of claim 21 further including the step of said one terminal counting a predetermined number of call failures and thereafter enabling emergency message data transmission to said EC.



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28. The emergency call handling method of claim 21 further including the step of detecting a failure to connect with a VC through to the EC due to congestion and thereafter initiating the step of transmission of the emergency data message.

5 29. An emergency call handling system for a cellular communication system for routing emergency calls made by a plurality of subscriber terminals to an emergency center (EC), said system comprising:

a mobile switching center (MSC) for controlling signaling with a plurality of base stations (BS's); and,

10 at least one subscriber terminal normally communicating with the MSC through one BS; and said one terminal including data transmission means for transmitting data messages including emergency data messages over a digital control channel (DCC) through the BS to the MSC; and,

data analyzing means in the MSC for analyzing the data messages received from said one terminal to route emergency data messages to the EC.

15 30. The emergency call handling system of claim 29 wherein the EC includes acknowledgment means that upon receipt of the emergency data message transmits an acknowledgment data message to the MSC, through the BS and over the DCC to said one terminal.

20 31. The emergency call handling system of claim 29 wherein the EC includes call back means responsive to the emergency data message that initiates a call back to said one terminal through the MSC, BS and over a voice channel (VC).

32. The emergency call handling system of claim 29 wherein said emergency data message includes 1) data information identifying the data message as an emergency and 2) data information relating to the identity of the terminal.

25 33. The emergency call handling system of claim 32 wherein the emergency data message further includes user medical history information.

34. The emergency call handling system of claim 32 wherein said emergency data message further includes data information corresponding to the location of the terminal.

30 35. The emergency call handling system of claim 29 wherein the means for analyzing the emergency data message includes means for adding to said emergency

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data message forwarded to the EC location information corresponding to the location of said terminal.

36. The emergency call handling system of claim 29 further including call failure detection means for detecting when an emergency voice call to the EC has failed to be set up and, responsive thereto, enabling the data transmission means to transmit the emergency data message.

37. The emergency call handling system of claim 36 wherein the call failure detection means includes count means which counts up to a predetermined number of call failures and thereafter enables the data transmission means to transmit said emergency data message.

38. The emergency call handling system of claim 36 wherein the call failure means enables the data transmission means to transmit said emergency data upon determination that a failure to set up a call with the voice channel through to the EC is the result of congestion.

39. A method for emergency call handling in a cellular communication system for routing emergency calls made by a plurality of subscriber terminals to an emergency center (EC) via a mobile switching center (MSC) controlling a plurality of base stations (BS's), said method comprising the steps of:

at least one subscriber terminal transmitting data messages, including emergency data messages, over a digital control channel (DCC) through the BS to the MSC; and,

analyzing in the MSC data messages received from said one terminal routing emergency data messages received in the MSC to the EC.

40. The emergency call handling method of claim 39 further including the step of the EC transmitting a data acknowledgment message to said one terminal through the MSC, BS and over a digital control channel upon receipt of the emergency data message to said one terminal.

41. The emergency call handling method of claim 39 further including the step of the EC initiating a call back to through the MSC, BS and over a voice to said one terminal after receipt of the emergency data message.

42. The emergency call handling method of claim 39 wherein said

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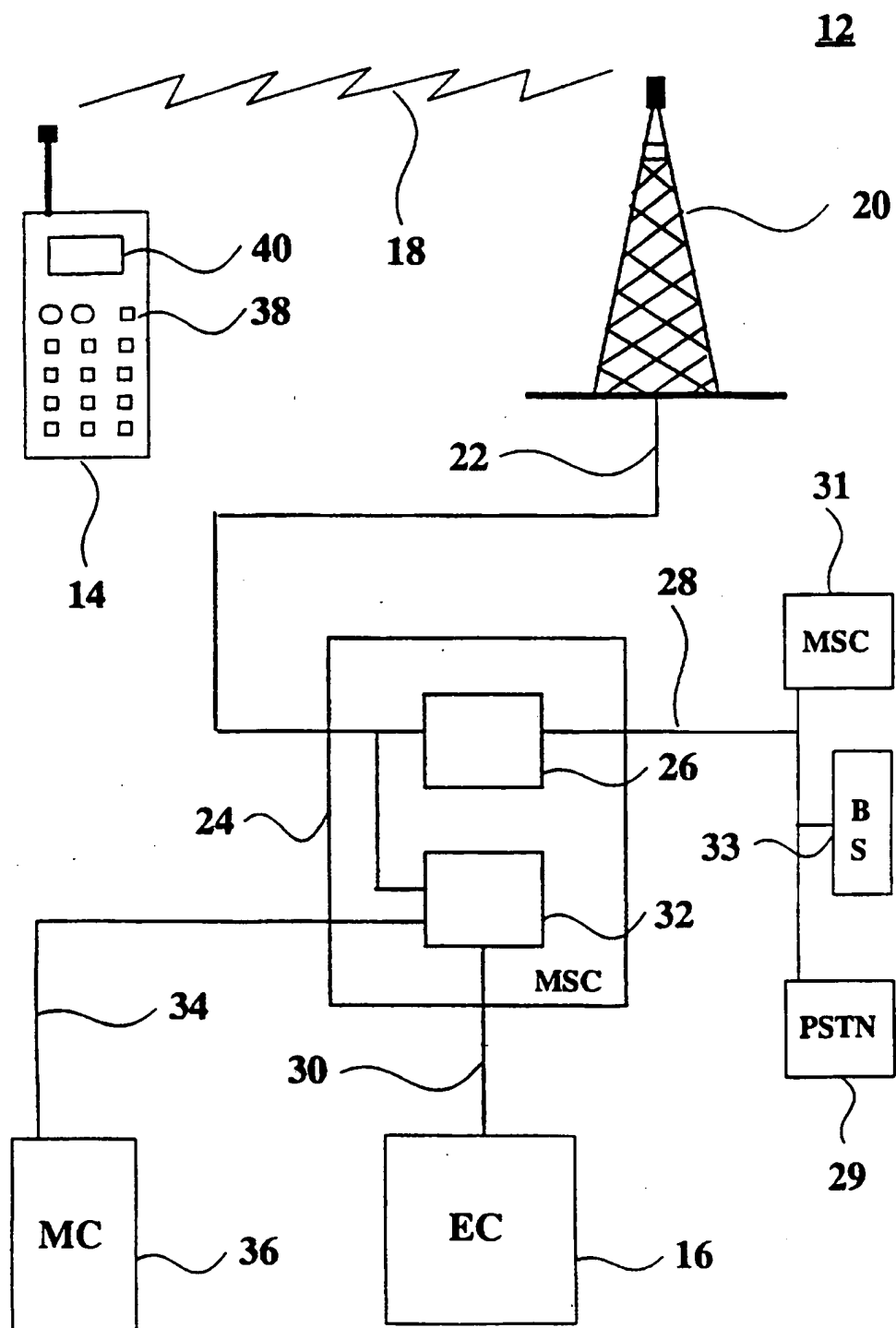


FIG. 1

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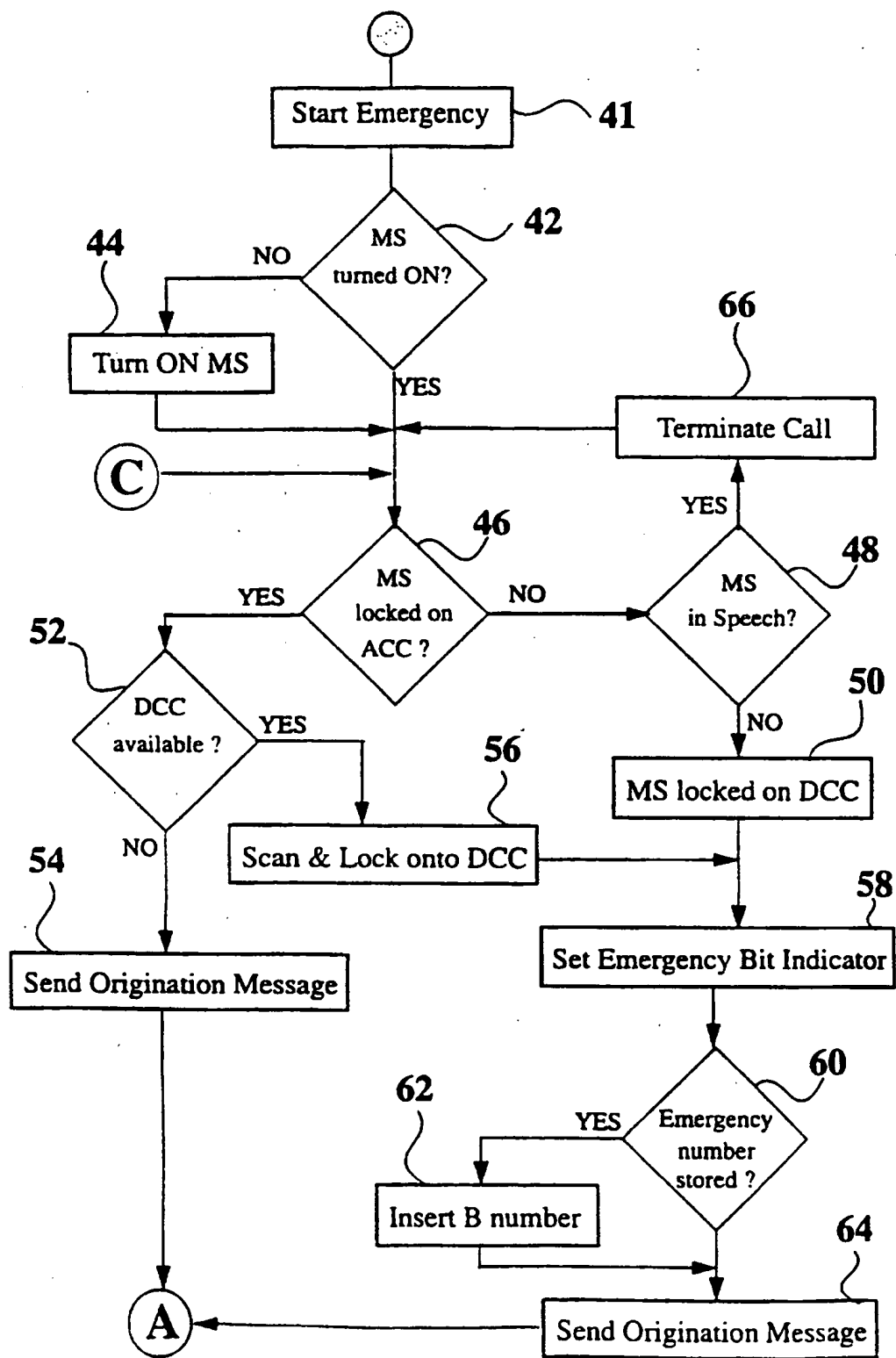


FIG. 2A

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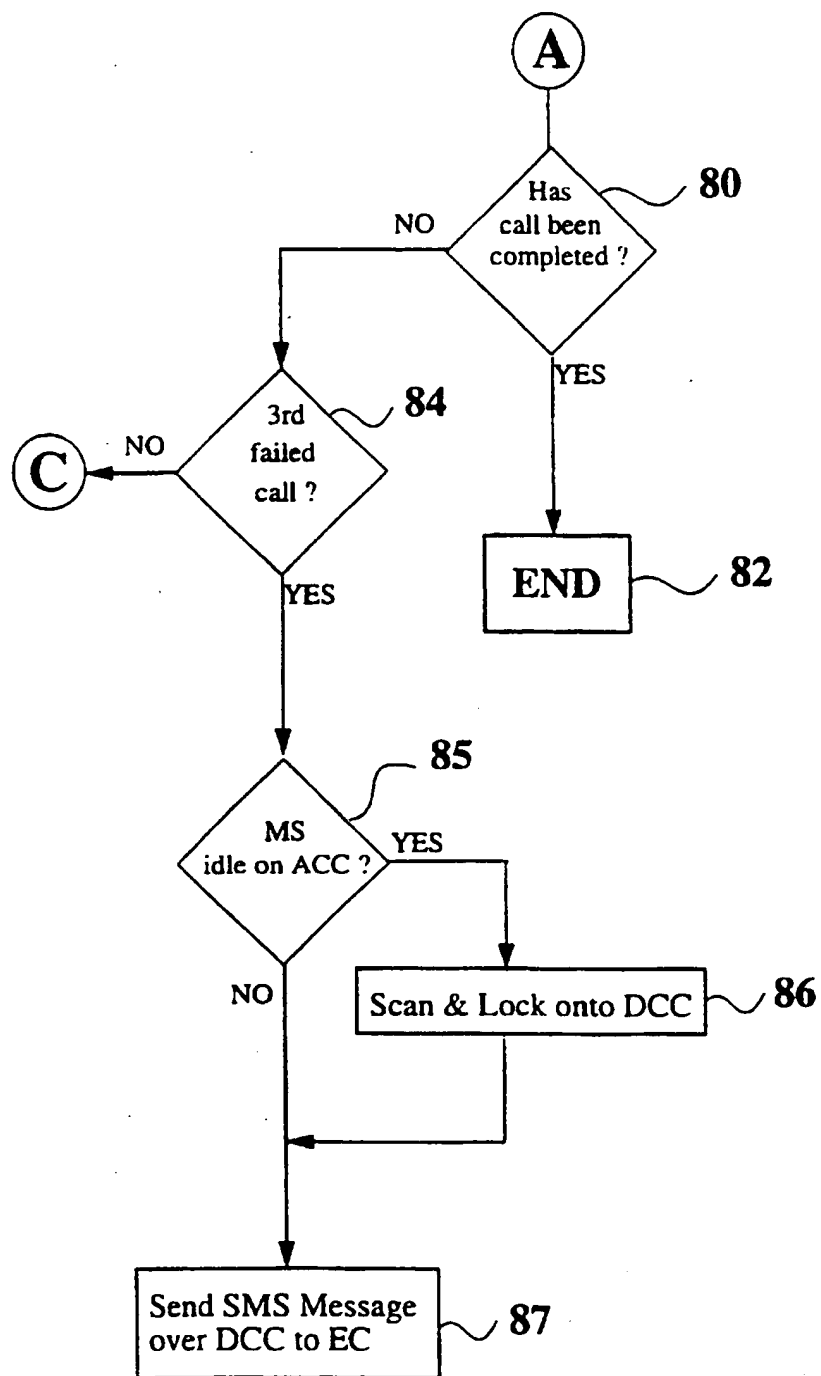


FIG. 2B

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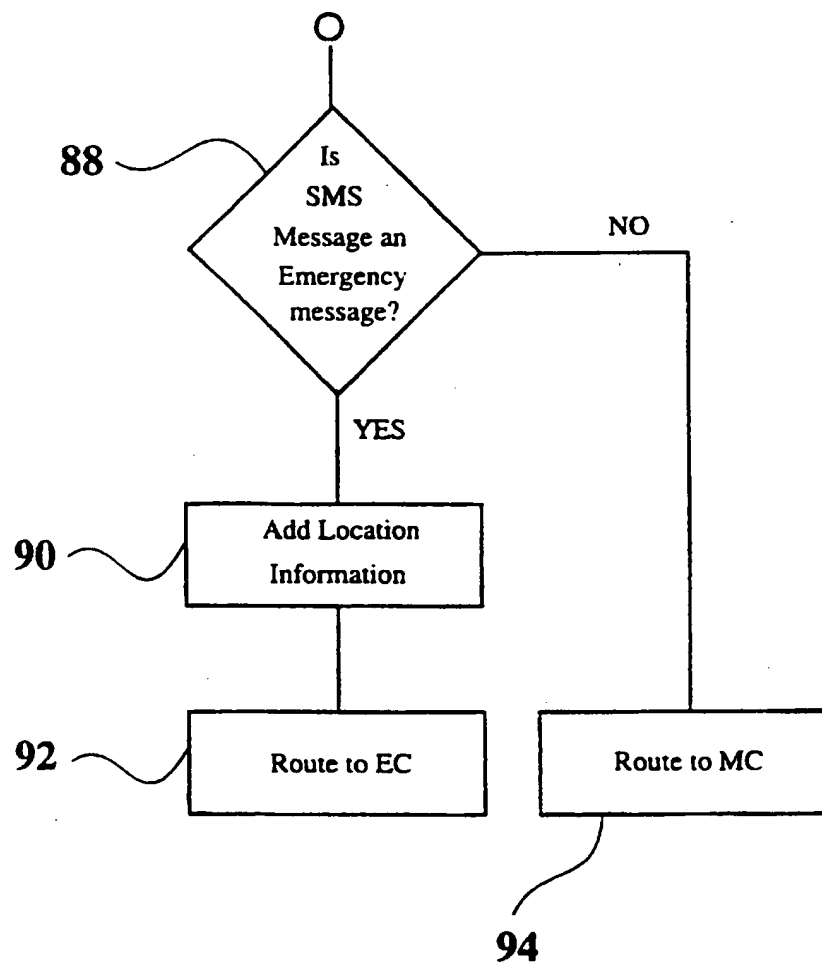


FIG. 3

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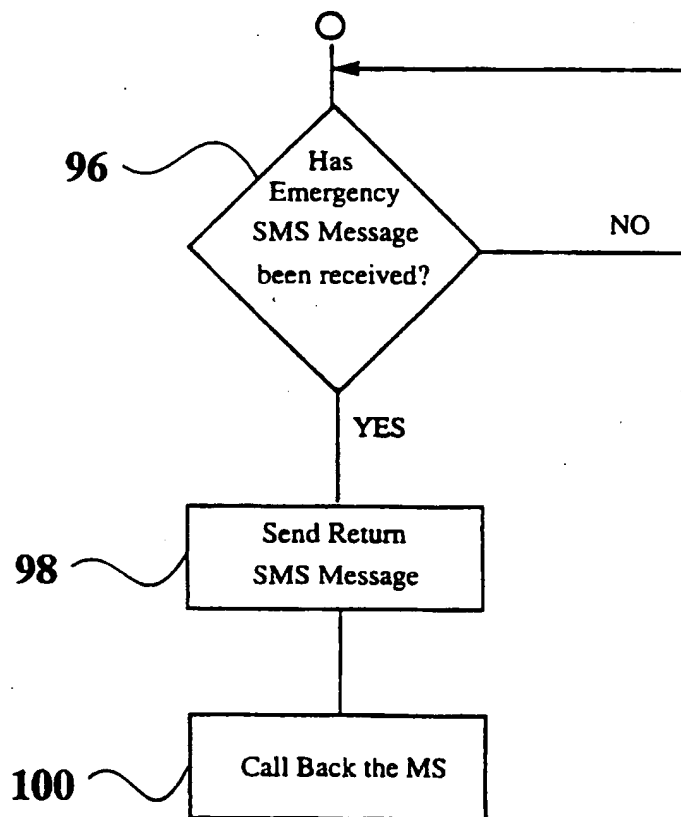


FIG. 4

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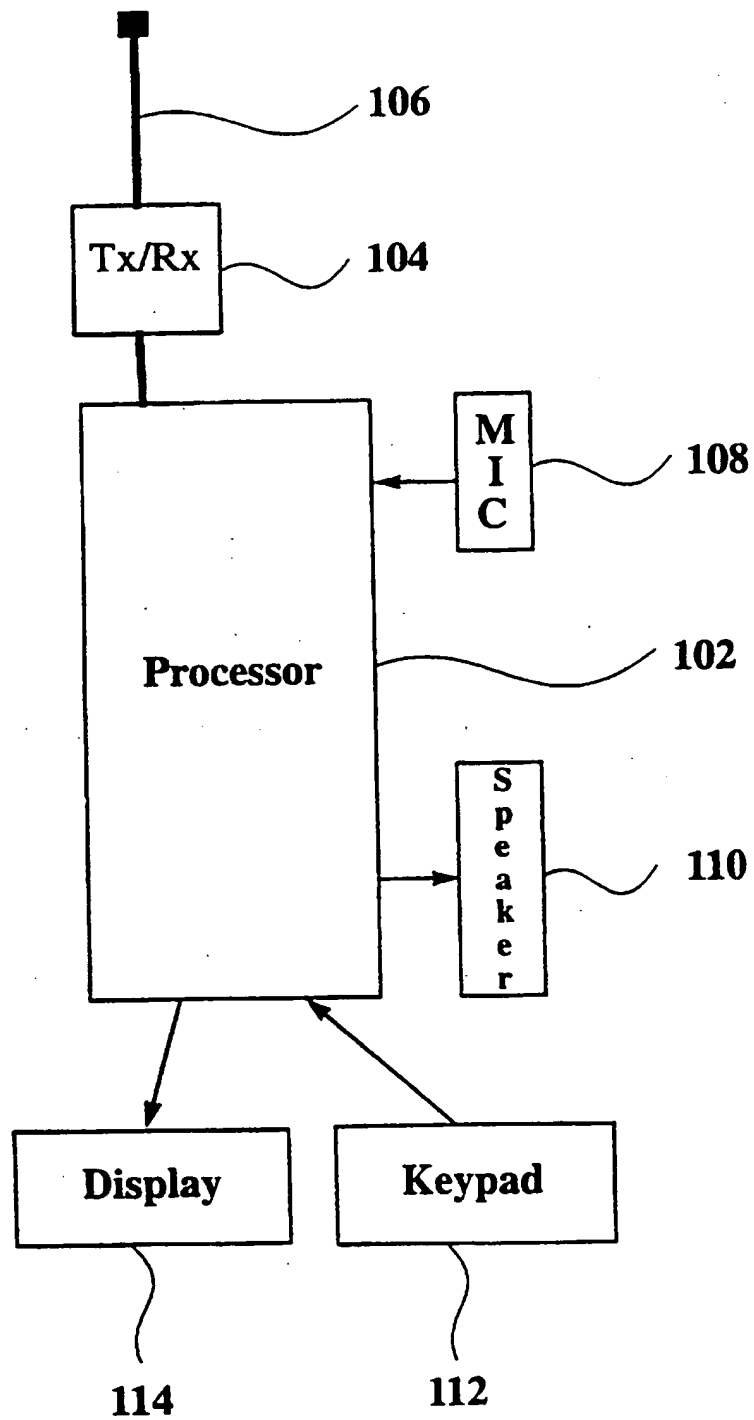


FIG. 5



# INTERNATIONAL SEARCH REPORT

International Application No

PCT/SE 96/01484

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 H04Q7/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No. |
|------------|---|-----------------------|
| Y          | WO 92 14329 A (TELENOKIA OY) 20 August 1992<br>see page 1, line 32 - page 3, line 2<br>see page 6, line 31 - page 7, line 19<br>--- | 1,11,21,<br>29,39     |
| Y          | DE 33 21 417 A (ANT NACHRICHTENTECHNIK GMBH) 20 December 1984<br>see the whole document<br>---<br>-/--                              | 1,11,21,<br>29,39     |

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

25 April 1997

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Behringer, L.V.

# INTERNATIONAL SEARCH REPORT

Int. onal Application No  
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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No. |
|------------|---|-----------------------|
| A          | <p>WIRELESS NETWORKS - CATCHING THE MOBILE FUTURE - 5TH IEEE INTERNATIONAL SYMPOSIUM ON PERSONAL, INDOOR AND MOBILE RADIO COMMUNICATIONS (PIMRC'94), AND ICC REGIONAL MEETING ON WIRELESS COMPUTER NETWORKS (WCN), PROCEEDINGS OF WIRELESS NETWORKS CATCHING, 1994, AMSTERDAM, NL, pages 939-943 vol.3, XP000612265</p> <p>COLLESEI S ET AL: "Short message service based applications in the GSM network" see page 943, left-hand column, line 1 - line 6</p> <p>-----</p> | 1,11,21, 29,39        |

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Information on patent family members

Inter. Appl. No.

PCT/SE 96/01484

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
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